New chromosome counts in Euphrasia

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RÉSUMÉ

Le nombre chromosomique diploïde $n = 11$ est rapporté pour *Euphrasia alpina, E. picta* et *E. hirtella* (n = env. 11) et le nombre tetraploïde $n = 22$ pour *E. pectinata.* Un comptage précédent pour "*E. hirtella*" de Grande-Bretagne se réfère en réalité à *E. rostkoviana.* La discussion comporte des remarques sur la parenté d'autres espèces d'euphraises grandiflores.

SUMMARY

The diploid chromosome number $n = 11$ is reported in *Euphrasia alpina, E. picta*, and *E. hirtella* (n = c. 11), and the tetraploid number $n = 22$ in *E. pectinata.* A previous count for "*E. hirtella*" from Britain is now referred to *E. rostkoviana.* The discussion includes remarks on the relationships of other large-flowered Euphrasia species.

ZUSAMMENFASSUNG

Die diploide Chromosomenzahl $n = 11$ wurde für *Euphrasia alpina, E. picta* und *E. hirtella* (n = ca. 11), und die tetraploide Zahl $n = 22$ für *E. pectinata* ermittelt. Eine frühere Zählung für "*E. hirtella*" der britischen Inseln wird jetzt auf *E. rostkoviana* bezogen. Die Diskussion bringt Bemerkungen über die Verwandtschaftsbeziehungen weiterer grossblütiger Euphrasia-Arten.

Results

In a previous paper (Yeo 1954) I have published chromosome counts for 15 British *Euphrasia* taxa. Using the method there described I have now obtained further counts at the stage of pollen mother cell meiosis from material originating in the Alps and cultivated in Cambridge in 1969. In the list that follows, numbers with the prefix E are the serial numbers of the samples; CGE indicates specimens preserved in the University Herbarium, Cambridge. The "fixed specimens" are those from which shoot apices were cut and fixed for cytological examination.

1. E. alpina Lam.

E 1072, Alpes-Maritimes, France; progeny of plants grown in 1968 from seed supplied by the Muséum national d'histoire naturelle, Paris (CGE 1968, 1969, including fixed specimens; herb. P. F. Yeo 1968, 1969): $n = 11$ (metaphase I, anaphase I, metaphase II).

E 1091, roadside above Brunnen, Simplon Pass, Valais, Switzerland, 1380 m alt., 5.8.1968 (CGE; herb. P. F. Yeo), cult. 1969 (CGE; herb. P. F. Yeo, including fixed specimens): $n = 11$ (metaphase I).

2. E. picta Wimmer

E 1119A, Enzinger Boden, Stubbachtal, Land Salzburg, Austria, 1480 m alt., 15.8.1968 (CGE; herb. P. F. Yeo), cult. 1969 (herb. P. F. Yeo): $n = 11$ (metaphase I, anaphase, I).

3. E. pectinata Ten.

E 1084, near Epinel, val de Cogne, Aosta, Italy, 1400 m alt., 3.8.1968 (CGE; herb. P. F. Yeo), cult. 1969 (CGE, including fixed specimens; herb. P. F. Yeo): $n = 22$ (metaphase I, anaphase I). In some cells at metaphase I in which a clear count was not possible one or two univalents were seen; in another such cell there were apparently four univalents.

4. E. hirtella Jordan ex Reuter

E 1101, Rothwald, Simplon Pass, Valais, Switzerland, 1745 m alt., 6.8.1968 (CGE, herb. P. F. Yeo), cult. 1969 (CGE): $n =$ c. 11 (metaphase I, only 3 cells, none of which gave a perfectly clear count).

The general appearance of the chromosome complements in these samples was the same as in those previously illustrated (Yeo 1954, 1956).

Discussion

In my previous paper on the chromosomes of *Euphrasia* (Yeo 1954), I reported a count of $n = 11$ for *E. hirtella* var. *polyadena* (Gren. & Roux) Pugsley, from Lawers, Mid Perth, Scotland. I have since come to the conclusion that *E. hirtella* does not occur in the British Isles, and that the Lawers material is best referred to *E. rostkoviana* Hayne. The tentative count given here for *E. hirtella* is therefore the

first that is truly applicable to that species. Another taxonomic decision of mine, not yet published, is that *E. tatarica* Fischer ex Sprengel is not separable from *E. pectinata* Ten.; therefore, although the foliage of E 1084 is strongly hairy, so that these plants would in the past have been referred to *E. tatarica,* they are here indicated as *E. pectinata.*

As previously pointed out (Yeo 1954), whereas Wettstein divided the species with long glandular hairs between series *Grandiflorae* and series *Parviflorae,* Pugsley placed them all together in series *Hirtellae,* a decision supported by the apparent restriction of the diploid chromosome number ($2n = 22$) to this group. However, this treatment involved disregarding the marked similarity between the large-flowered *E. rostkoviana* Hayne (the commonest species of series *Hirtellae*) and the eglandular *E. kerneri* Wettst., a similarity strongly emphasised by Wettstein (1896). Pugsley (1936), following Rothmaler (1935), placed *E. kerneri,* and the earlier-flowering species *E. picta* Wimmer and *E. versicolor* Kerner, in series *Alpinae.* Recently Schaeftlein (1967) has thoroughly studied the occurence of the large-flowered glandular species *E. rostkoviana* and *E. montana* Jord. and the large-flowered eglandular species *E. kerneri, E. versicolor* and *E. picta,* and has found that over a large part of the eastern Alps, Bavaria, Moravia and neighbouring areas, glandular and eglandular forms, otherwise indistinguishable, grow together. Furthermore, he found that from such populations the progeny of glandular plants included some eglandular plants, and vice versa. He concluded that such mixed populations constitute single breeding groups ("gamodemes") with gene-exchange between the two forms, and that the glandless taxa should provisionally be incorporated in an aggregate species under the name *E. rostkoviana.* In view of this one would expect the three eglandular taxa of this group to be diploid, and this is partly confirmed by the count here reported from Enzinger Boden. These plants came from a mixed population of glandular and eglandular plants; they are rather more branched and begin to flower at a slightly higher node than is the case with the most typical forms of *E. picta,* but agree with a description of this species which I drew up for "Flora Europaea" before I was aware of the intergradation with *E. rostkoviana.* The chromosomes were counted separately in two individual plants.

This group of plants evidently presents an awkward taxonomic problem, and I am not attempting to provide a solution here. However, the facts indicate that at least some of the species of series *Alpinae* ought to be placed together with some or all of those in series *Hirtellae.*

The relationship of *E. alpina* (the type species of series *Alpinae*) to the *E. kerneri* group is not yet clear. The chromosome number is the same, but the morphology is so different that *E. alpina* may deserve separate classification (together with its ally, *E. cisalpina* Pugsley). Indeed, it is possible that *E. alpina* and a member of the *E. rostkoviana* aggregate are joint parents of some or all of the European tetraploid groups other than subsection *Angustifoliae,* the *E. salisburgensis* group (see Yeo 1954: 106-107 and Yeo 1968: 736-737). The discovery of the diploid number in *E. alpina* is relevant to the origin of *E. christii* Favrat. This species was believed by Wettstein (1896) and Pugsley (1930) to be a hybrid between *E. alpina* and *E. minima* Jacq. ex Lam. & DC., which is a tetraploid species (Witsch 1932). *E. christii* may, therefore, be analogous to *E. vigursii* Davey, a diploid species believed to have originated by the crossing of another diploid species with a tetraploid (Yeo 1956).

Nomenclatural Note.

For convenience, the nomenclature used here for the subdivisions of the genus *Euphrasia* is that of Pugsley (1936), although this is not in accord with the International Code of Botanical Nomenclature (ed. 1966); it is hoped that a publication containing correct infrageneric nomenclature will appear soon (Sell and Yeo ined.).

BIBLIOGRAPHY

Pugsley, H. W. (1930) A revision of the British Euphrasiae. *J. Linn. Soc. Bot.* 48: 467-542.

– (1936) Enumeration of the species of Euphrasia L., sect. Semicalcaratae Benth. *J. Bot.* 74: 273-288.

Rothmaler, W. (1935) Generum plantarum ibericum revisio critica, III. Euphrasia L. *Cavanillesia* 7: 5-28.

Schaeftlein, H. (1967) Beiträge zur Kenntnis einiger mitteleuropäischer Euphrasien, I. Der taxonomische Wert der drüsigen Behaarung. *Phyton (Horn)* 12: 48-90.

Sell, P. D. & P. F. Yeo (ined.) *A revision of the North American species of Euphrasia L.*

Wettstein, R. von (1896) *Monographie der Gattung Euphrasia.* Engelmann, Leipzig.

Witsch, H. von (1932) Chromosomenstudien an mitteleuropäischen Rhinantheen. *Österr. Bot. Z.* 81: 108-141.

Yeo, P. F. (1954) The cytology of the British species of Euphrasia. *Watsonia* 3: 101-108.

– (1956) Hybridisation between diploid and tetraploid species of Euphrasia. *Watsonia* 3: 253-269.

– (1968) The evolutionary significance of the speciation of Euphrasia in Europe. *Evolution* 22: 736-747.

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